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TECHNICAL NOTE / *Genito-urinary imaging*

Morphometric scores for kidney tumours: Use in current practice

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Tissue masses in the kidney discovered by chance are continuously increasing with the diffusion of imaging in cuts. They make up a very heterogeneous and progressive anatomopathological contingent, the treatment of which has considerably changed over the past 20 years, both in the pretreatment evaluation and in the surgical approach, where partial nephrectomy (PN) has become the standard due to its good results on the cancer and progress in surgical techniques. PNs have been enriched by percutaneous removal treatments that complete the therapeutic range offered to patients. However, if PN makes kidney conservation possible with a long-term survival rate that is identical to that of larger nephrectomise, they cause more common per- and pericomplications (19 to 25%). Currently, if there are not true tumoural prognosis factors, each patient befits in RCP from a personalised pre-therapeutic and therapeutic proposal that is locally adapted to technical settings and medico-surgical teams.

Clinical interest

Like the Bosniak classification, morphometric scores give a ranking based on the size and location of the tumour using a CT-scan or MRI.

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These scores were suggested by Kutikov (RENAL nephrometry score) and Ficcara (PADUA) in 2009 and by Simmons (C-Index) in 2010 in order to standardise series and give radiologists the tools to make it possible to classify tissue masses and provide information that would allow urologists to offer suitable therapeutic choices based on objective morphological data [1—3]. The first series published using these classification criteria show a good interobserver reproducibility [4] and provide prognosis evaluation information on per- and perioperative morbidity [5]. This can significantly predict ($P < 0.001$) the risk of complication, while the size of the lesion or its anterior or posterior location taken alone (univariate analysis) does not make it possible to conclude [1]. In addition, the morphometric score is an interesting piece of information for predicting the peroperative clamping time: the higher the score (PADUA and R.E.N.A.L.), the longer the ischaemia time, which indirectly appreciates operative difficulties ($P < 0.001$) [6].

Anatomical classifications

PADUA

Preoperative Aspects and Dimensions Used for an Anatomical classification. This score varies from 6 to 14 (Table 1) and takes into account five lesional anatomical characteristics in addition to the maximum diameter. A score of 8 and 9 makes it possible to identify patient groups with a risk of complication 14 times higher than with scores of 6 and 7. Concerning the reproducibility of the determination of the PADUA score, the interobserver correlation is approximately 73% [5].

Table 1 Preoperative aspects and dimensions used for an anatomical classification morphometric score.

Anatomical descriptions[a]	Score
Longitudinal tumour location (polar)	
Superior/inferior	1
Mean	2
Exophytic	
> 50%	1
< 50%	2
Endophytic	3
Axial tumour location	
Lateral	1
Medial	2
Sinus of the kidney	
Not infiltrated	1
Infiltrated	2
Tumour size (cm)	
≤ 4	1
4.1—7	2
> 7	3

[a] The anterior or posterior location can be indicated with the letters (''a'' or ''p'') after the score.

RENAL

Radius: maximum diameter of the lesion, E: exophytic or endophytic tumour, N: nearness or tumour extension in depth. This score varies from 4 to 12 (Table 2) to which the two suffixes a or p for anterior or posterior are attributed and the letter h if the lesion is in contact with the vein or main artery. In this score, the maximum transverse diameter: R (Radius) is a statistically significant predictive marker ($P = 0.02$) of the risk of complication in studies with a single variable. In multivariate studies, a RENAL score greater than or equal to 9 is an independent and reliable factor of the risk of complication. A score of 10 to 12 increases the risks of major complications 5.4 times [7].

C-Index

Index that calculates the ratio of the distance of the centre of the tumour to the centre of the kidney: c for the size of the tumour: r C-index = c / r [3]. This score (Fig. 1) varies from 0 with an upper limit dependent on the size and distance of the tumour from the centre of the

Table 2 RENAL morphometric score.

	1 point	2 points	3 points
(R)adius (maximum diameter in cm)	≤ 4	> 4 but < 7	≥ 7
(E)xophytic (exophytic development)	≥ 50%	< 50%	Entirely endophytic
(N)earness (nearness of the tumour to the urine collection system in mm)	≥ 7	> 4 but < 7	≤ 4
(A)nterieur/Posterior	No given point, but it is specified in the tumour description, a, p or x		
(L)ocation (tumour location relative to polar lines[a])	Entirely above the upper polar line or below the lower polar line	The lesion exceeds the polar lines	> 50% of the lesion exceeds a polar line or crosses the axial or medio kidney line or is located entirely between the polar lines
Suffix ''h'' assigned to a tumour reaching the main artery or vein			

[a] A diagram is available on the internet on the website www.nephrometry.com.

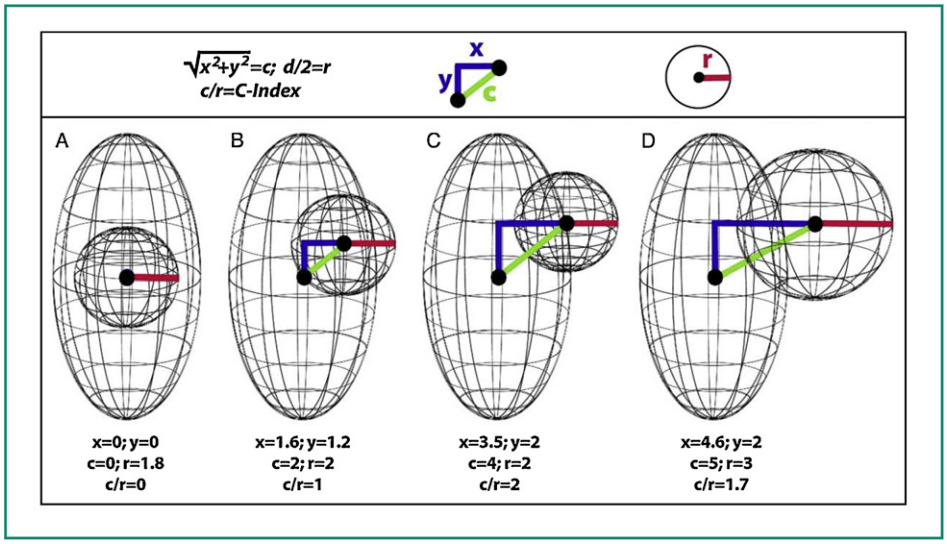

Figure 1. According to Simmons [3], the distance between the two centres of the tumour and the kidney is calculated using the Pythagorean Theorem: $c = \sqrt{(x^2 + y^2)}$. The index is obtained by the ratio of the distances of the two centres (C) divided by the ray of the mass.

kidney. A C-index of 2.5 increases, for example, by 30% the risk of a major complication. This method appears to be more complex to implement and requires a longer learning curve.

Conclusion

Use of morphometric scores to evaluate kidney tumours is a more rigorous approach to their treatment, even if these methods remain imperfect and do not include, for example, the speed of growth and the anatomopathological Fuhrman score, which are currently the most commonly used prognostic factors. These classifications are relatively close, and the PADUA score appears to be the easiest to implement. Communication in the CT-scan and MRI reports of a PADUA or RENAL score should make it possible to make the prognostic evaluation of kidney tumours by radiologists more homogeneous. The use of this score in preoperative evaluation of percutaneous thermal ablations remains to be defined.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References

[1] Ficarra V, Novara G, Secco S, Macchi V, Porzionato A, De Caro R, et al. Preoperative aspects and dimensions used for an anatomical (PADUA) classification of renal tumours in patients who are candidates for nephron-sparing surgery. Eur Urol 2009;56:786—93.

[2] Kutikov A, Uzzo RG. The R.E.N.A.L. nephrometry score: a comprehensive standardized system for quantitating renal tumor size, location and depth. J Urol 2009;182:844—53.

[3] Simmons MN, Ching CB, Samplaski MK, Park CH, Gill IS. Kidney tumor location measurement using the C-index method. J Urol 2010;183(5):1708—13.

[4] Weight CJ, Atwell TD, Fazzio RT, Kim SP, Kenny M, Lohse CM, et al. A multidisciplinary evaluation of inter-reviewer agreement of the nephrometry score and the prediction of long-term outcomes. J Urol 2011;186(4):1223—8.

[5] Hew MN, Baseskioglu B, Barwari K, Axwijk PH, Can C, Horenblas S, et al. Critical appraisal of the PADUA classification and assesment of the R.E.N.A.L. nephrometry score in patients undergoing partial nephrectomy. J Urol 2011;186:42—6.

[6] Simhan J, Smaldone MC, Tsai KJ, Canter DJ, Li T, Kutikov A, et al. Objective measures of renal mass anatomic complexity predict rates of major complications following partial nephrectomy. Eur Urol 2011;60(4):724—30.

[7] White MA, Haber GP, Autorino R, Khanna R, Hernandez AV, Forest S, et al. Outcomes of robotic partial nephrectomy for renal masses with nephrometry score of ≥7. Urology 2011;77(4):809—13.